REMARKS

Claims 1-23 and new claims 24-25 remain in this application for the Examiner's review and consideration. Formal drawings as replacement sheets are attached herewith for the Examiner's consideration. No change is made to the drawings.

Claims 1-23 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. patent no. 6,723,460 to Derflinger *et al.* ("Derflinger") in view of U.S. patent no. 6,630,518 to Paronen for the reasons given on pages 2-3 of the Office Action. The Examiner asserted that Derflinger discloses all of the aspects of the present invention including a fuel cell system that utilizes an ion exchanger unit to purify fuel before it reaches a fuel cell. However, Derflinger was said to lack disclosure regarding the type of material employed in the ion exchanger, its location in the system and its physical form. The Examiner also stated that Paronen discloses perfluorinated sulfonic acid polymers of the type recited. For the following reasons, this rejection is respectfully traversed.

Independent claim 1 recites, in part, that the "fuel exiting the filter contains less metal ions than fuel entering the filter." Similarly, independent claim 15 recites, in part, that "the fuel exiting the ion filter has a second amount of ions less than said first amount of ions". Independent claim 20 has been amended to recite, in part, that the filter medium "reduce[s] the metal ions in the fuel or in the byproduct."

Therefore, embodiments of the present invention ,recited in the independent claims and currently amended, remove metal ions from the fuel. The removal of metal ions from a fluid necessarily changes the conductivity of that fluid. In fact, as described in the present application, for example on page 10 at lines 13-31, ion sensors can be used to ascertain the effectiveness of the filter by measuring the electrical conductivity of the fuel. If ions were not removed, the conductivity would not change. Therefore, fuel filters in accordance with the present invention are

selected for an ability to remove metal ions or to reduce the level of metal ions enough to change the conductivity of the fuel.

On the other hand, Derflinger is directed to a fuel cell system where a mixture of methanol and water is passed through an ion exchanger unit (3) where impurities are removed without reducing the electrical conductivity of the medium flowing through it. In addition, the ion exchanger unit serves as a coarse filter. (col. 2, lines 7-23 and 46-47). The ion exchanger unit (3) cannot reduce the level of metal ions, as claimed in the present invention, when it does not reduce the electrical conductivity of the fuel.

To the best of Applicants' knowledge, the ion exchanger of Derflinger is similar to common ion exchangers used to soften water. Known water softeners do not remove ions from a fluid flow, but exchanges or replaces ions in the water, *i.e.*, removes undesirable ions and replaces them with less harmful or corrosive ions. Ion exchangers in general work on the principle of exchanging ions and in fact exchange a chemically balanced number of ions as described, for example, in "*The Ion Exchange Principle*" available http://www.freedrinkingwater.com/water-education2/46-ion-exchange-principle.htm, a copy of which is attached hereto as Attachment A for the Examiner's review. Exchanging ions in a chemically balanced manner results in no net change in conductivity.

Thus, the fuel cell systems of Derflinger teach one of ordinary skill in the art to make systems that do not remove ions or change the conductivity of fuel. On the other hand, the claims of the present invention recite the removal of metal ions.

The deficiencies of Derflinger are not remedied by Paronen. Paronen is directed to a polymer membrane and to a new process for the preparation of sulfonated polymer membranes where a polymer film is irradiated with ions or gamma radiation in order to produce reactive sites. The irradiated membrane material is sulfonated in order to link sulfonic acid groups to it. The

membranes are preferably made from materials that are not substantially porous. (col. 4, lines 12-14). There is no teaching or disclosure in Paronen regarding the use of the sulfonated polymer membranes as to remove metal ions for fuel cells fuel. Hence, a hypothetical combination of Derflinger and Paronen would not have all the elements of independent claims 1, 15 and 20 of present invention

Moreover, one of ordinary skill in the art would not look to combine Paronen with the disclosure of Derflinger. The ion exchange membranes of Derflinger also serve as a coarse filter. However, the membranes of Paronen are constructed so as to be substantially non-porous. These non-porous membranes could not serve as a coarse filter or as any type of filter or physical sieve. Therefore, one of ordinary skill in the art looking for alternatives to the coarse filter membranes of Derflinger would not look to the non-porous membranes of Paronen.

Therefore, the present invention is not rendered obvious by reference to Derflinger in view of Paronen, and the Applicants respectfully request reconsideration and withdrawl of this rejection.

Applicants note that claims 2-14, 16-19 and 21-23 depend either directly or indirectly from claims 1, 15 or 20 and contain additional recitations that further define the present invention over the cited prior art. Hence, these claims are also currently patentable due to their dependency, and Applicants believe that it is unnecessary to address these specific grounds of rejection of the dependent claims at this time. However, Applicants reserve the right to address these rejections should that become necessary.

New claims 24-25 have been added to more fully describe the present invention. Support of the new claims can be found on page 10 at lines 13-31 of the specification.

Applicants assert that all claims are now in condition for allowance, early notice of which is respectfully requested. If the Examiner believes, for any reason, that personal communication

will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided. No fees are believed due in connection with the submission of this Amendment. If any fee is due, the Commissioner may charge appropriate fees to H.T. Than Law Group, Deposit Account No. 50-1980.

Respectfully submitted,

Date March 23, 2006

H.T. Than (Reg. No. 38,632)

The H.T. Than Law Group
Waterfront Center
1010 Wisconsin Avenue, NW, Suite 560
Washington, DC 20007
(202) 363-2620

Water Education

Learning Center Categories:

Water And Health

Learn About Water Quality

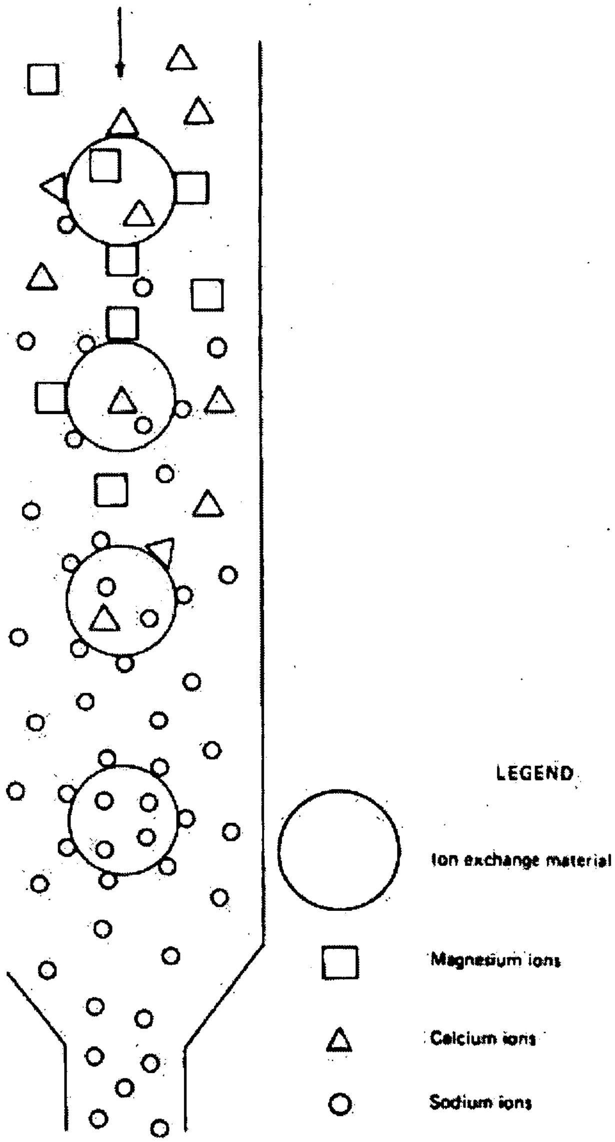
- The "Truth" on our water
- Contaminants and their health effects
- Water quality problems and treatment solutions
- Sources of our drinking water
- Standards for drinking water
- Hard and soft water
- pH value of water
- Filtration OR Purification?
- Myth on minerals and water

THE ION EXCHANGE PRINCIPLE

The idea of ion exchange is not new. Scientists have been aware of the principle for a long time. However, it has only been since the start of the present century that the principle has been put to practical use. One area in which it has been highly effective has been in the treatment of water for removal of hardness minerals and certain other contaminants.

THE ION EXCHANGE COLUMN

HARD WATER ENTERING SOFTENER



All recognized household water softening equipment now on the market makes use of the ion exchange principle. Equipment using this principle contains a bed of permanent bead-like or granular softening material through which the water flows. As the water travels through the bed of ion exchange material, the hardness minerals are removed, leaving the water soft and more satisfactory for household use.

Bed. The granules or particles of ion exchange material in a softener are referred to as the bed.

The ion exchange material (usually resin beads or granules) consists of permanent insoluble anions, kept electrically neutral by replaceable sodium cations. Hard water contaminated with calcium and magnesium ions enters the exchange column or bed. As it flows through it, the magnesium and calcium cations in the water are drawn to the anions of the ion exchanger. The ion exchanger has a greater affinity for the calcium and magnesium ions than for the sodium ions. Therefore, the calcium and magnesium ions are absorbed, and a chemically equivalent number of sodium ions is released into the water. Thus, a water containing the ions of calcium bicarbonate when it enters, contains the ions of sodium bicarbonate as it leaves the ion exchanger bed. In brief, harmless sodium ions have replaced the troubleproducing hardness ions.

Ion exchange occurs literally billionns of times between the material in the exchange column and the minerals in the water as softening proceeds. *(--> Next)*

More Topics on Water Quality & Treatment:

General water treatment
Water quality defined
Hydrologic cycle of water
Meteoric water and cycle
Environmental factors of water
Age of ground water
Temperature of ground water
Water quality of surface water
Cistern water quality
Summary of water quality and the environment

Hard water explained
Hard water problems
Softened water energy savings
Hard water analysis
Hard water and soap curd
Ion exchange principles
More on water softening
Home water softener basics
Water deionization
Lime soda ash water treatment
Water softener alternatives

3 Types of basic water
TDS-Total dissolved solids
Reverse osmosis treatment
Alkalinity of water
Reverse osmosis and pH
Carbon dioxide in water
Chloride and sulfate
Fluoride in drinking water
Hydrogen sulfide in water
Nitrate/ nitrogen in water
Oxygen in drinking water
Silica in drinking water
Sodium/methane/ phenol

Disease-causing organisms
Micro-organism in water1
Micro-organism in water2
Viruses in drinking water
Bacteria in drinking water
Water disinfect methods1
Water disinfect methods2
Water disinfect-chlorine
Dechlorinating filters Q&A
Palatability of water
Turbidity of drinking water
Mechanical filtration
Multi-media (depth filters)
Color of drinking water

osmosis water filtration is the most thorough method of water purification. We have been promoting reverse osmosis for 18 years. Our team of reverse osmosis experts are here to serve you! Reverse osmosis purifiers are our business.

Apec = Products of Superior Performance and Dependability

Water Education

CONTINUED...

MORE ON WATER SOFTENING AND ION EXCHANGE

Now when this calcium bicarbonate in solution flows through the exchange material in the softener, the chemical change which occurs is diagrammed below.

After a vast number of hardness ions in the water has become affixed to the softening material through the attraction of positive and negative charges, and most of the sodium ions have been released, the unit can no longer soften the water. It has become temporarily exhausted.

In actual practice, a small number of sodium ions remains on the softening material after the unit is exhausted. If no new chemical reaction is set into operation at this point, the incoming calcium bicarbonate ions flow untouched through the unit.

Just one of the ions causing hardness is shown for sake of clarity in diagramming. Actually, most water supplies contain a number of various hardness ions. The same process in each case applies equally in their removal from the water.

Water Entering Softner:

(1) The calcium ions in the water enter the ion exchange column. Here the waters pass through the bed of the softening material.

(2) The softening material consists of fixed irreplaceable anions. Affixed, that is, chemically bonded to them are mobile, replaceable cations of sodium.

(3) As the softening material anions have a greater affinity for the calcium ions than for sodium ions, it attracts them. In the process the calcium ions "knock" the sodium ions off the

exchange material. As this continues, the exchange or softening material becomes loaded with calcium ions. Note that two sodium ions are released for each of the calcium ions absorbed by the softener.

Water Leaving Softner:

Water that contains calcium ions as it enters the softener will have a chemically equivalent amount of sodium ions in it on leaving the softener.

(4) After a certain prescribed amount of water has gone through the unit, the calcium ions will replace all but a small percentage of the sodium ions in the softener At this point, the softener is considered (Unit is now exhausted and requires regeneration).

(5) Now a rich brine solution is introduced into the softener by backwashing.

Note: to recharge a softener a concentrated solution of the regenerant (sodium chloride) is accumulated calcium ions free of the softening material.

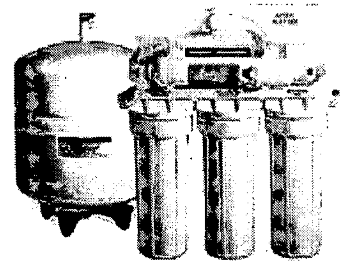
(6) The calcium ions and excess brine solution are rinsed away.

(7) When this process is completed, the unit is again charged with sodium ions and is ready to continue the process of softening the water.

RECHARGING OR REGENERATION

Recharging or regeneration is necessary at this point. To do this a reverse ion exchange operation is now put into motion. In this reverse process, it is necessary to bombard the exchange material with the original type of cations in a concentrated solution. The affinity of the exchanger for the hardness ions is overcome by the use of a relatively strong solution of sodium ions. Generally, sodium chloride in a concentrated solution is used for this purpose. What occurs in all examples of ion exchange is a "swap" or balanced exchange of ions.

The calcium ions in the softening process are not destroyed. They have merely been replaced in the water by a chemically equivalent amount of sodium ions. The same type of balanced exchange occurs with whatever other hardness minerals that are removed from water. *(--> Next)*



Healthy and Convenient! Our Featured Reverse Osmosis Drinking Water System

More Topics on Water Quality & Treatment:

General water treatment
Water quality defined
Hydrologic cycle of water
Meteoric water and cycle
Environmental factors of water
Age of ground water
Temperature of ground water
Water quality of surface water
Cistern water quality
Summary of water quality and the environment

Hard water explained
Hard water problems
Softened water energy savings
Hard water analysis
Hard water and soap curd
Ion exchange principles
More on water softening
Home water softener basics
Water deionization
Lime soda ash water treatment
Water softener alternatives

3 Types of basic water
TDS-Total dissolved solids
Reverse osmosis treatment
Alkalinity of water
Reverse osmosis and pH
Carbon dioxide in water
Chloride and sulfate
Fluoride in drinking water
Hydrogen sulfide in water
Nitrate/ nitrogen in water
Oxygen in drinking water
Silica in drinking water
Sodium/methane/ phenol

Disease-causing organisms
Micro-organism in water1
Micro-organism in water2
Viruses in drinking water
Bacteria in drinking water
Water disinfect methods1
Water disinfect methods2
Water disinfect-chlorine
Dechlorinating filters Q&A
Palatability of water
Turbidity of drinking water
Mechanical filtration
Multi-media (depth filters)
Color of drinking water

We are proud to be the authoritative website of Information on water quality solutions, water purification by reverse osmosis. Reverse osmosis water filters and purifiers can remove contaminants caused by industrial and agricultural water pollution and water contamination to provide safe and pure drinking water. Many of our top quality home reverse osmosis water filter systems are currently on sale. Did you know, reverse osmosis water filtration is the most thorough method of water purification. We have been promoting reverse osmosis for 18 years. Our team of reverse osmosis experts are here to serve you! Reverse osmosis purifiers are our business.

Apec = Products of Superior Performance and Dependability

Home of reverse osmosis drinking water filter
Reverse Osmosis Products
- RO-45
- RO-90
- RO-PERMEATE
- RO-COUNTERTOP

Replacement Filters & Parts
Shower Filters and Bath Balls

F.A.Q.s
Reverse Osmosis Technical Center
Learn the Truths About Our Drinking Water
Contaminant Fact Sheets
Water Can Cure Diseases
Water And Our Health
Top Water News

Contact APEC
Current Promotions
Our Reviews
About APEC
Refer & Get Cash
Warranty
APEC Reverse Osmosis Water Filters